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THE SCENERY OF SCOTLAND.

The Scenery of Scotland viewed in Connexion with its Physical Geology. By Archibald Geikie, LL.D., F.R.S. (London: Macmillan, 1887.)

THAT truth is great, and that it will in the end carry the day, we are assured by the most venerable and most hackneyed of aphorisms. We profess implicit belief in the doctrine, but, as we survey the history of the growth of opinion, our faith is apt to be rudely shaken when we note countless instances of the marvellous persistence and vitality of notions, however erroneous they may be, when they have once become firmly rooted in the minds of men. It is at such times hard to help doubting whether the vaunted power of knowledge is always competent to sweep away the dead weight of prejudice and obstinacy which cumbers the approaches to the abode of truth. The infancy of every science furnishes illustrations of the tenacity with which even men of science cling to preconceived beliefs, none perhaps more striking than that supplied by the branch of geology which the volume before us is intended to illustrate.

Well-nigh a century has slipped away since Hutton enunciated the doctrine that the surface features of the land are in the main due to the carving and sculpturing action of denudation, and gave reasons for his belief which are now held to be unanswerable by nearly every geologist. But his proved to be a veritable voice crying in the wilderness. Scrope reiterated the truth and enforced it by fresh examples, notably those furnished by Auvergne; but his testimony availed not to charm ears still deaf or unwilling to be convinced. Even Ramsay, afterwards a most strenuous champion of the doctrine, failed to see the whole truth when he wrote his classical memoir on "The Denudation of the South-West of England." Jukes struck the right note in his memorable paper on "The River-Valleys of the South of Ireland"; Ramsay, the year following, gave precision and definite shape to the theory, which had so long a birth-throe, in his "Physical Geology and Geography of Great Britain"; Foster and Topley showed how this theory furnished a rational explanation of the growth of the puzzling physical geography of the Weald of Kent and Sussex; and Whitaker summed up the evidence in its favour in a paper singularly exhaustive in its facts and lucid in its arguments. Nothing perhaps shows more forcibly the difficulty of persuading mankind even to listen to views which seem new to them, than the fact that Whitaker's singularly temperate and unaggressive memoir was refused a place in their Quarterly Journal by the Council of the Geological Society of London. The writer may perhaps claim to have added his mite when, following in the steps of these pioneers, he pointed out how the striking escarpments and dip-slopes of the Millstone Grit moors in Derbyshire and Yorkshire have arisen.

It was when the controversy was at its height that Dr. A. Geikie furnished a weighty and memorable contribution to it in his work on "The Scenery of Scotland viewed in Connexion with its Physical Geology." He then gave no uncertain sound as far as his own convictions went, but he admitted in his preface that the views to which he had been led ran directly counter to what were at that time the prevailing impressions on the subject of the book, and that he was prepared to find them disputed or perhaps thrown aside as mere dreaming. Now, after a lapse of twenty-two years, during which many a young geologist has been hungering for access to the book long out of print, a second edition appears, and the author is able to state that these very views are accepted as part of the general stock of geological knowledge. How largely this result is due to his own steady and powerful advocacy all geologists are aware; but he gracefully reminds us that we also owe much to the labours of those American geologists who have found in the Western Territories such convincing instances of the work of denudation in shaping the surface, and have further brought these instances to our doors by means of the admirable illustrations of them which they have supplied in such profusion, and which the American Government distribute so liberally among the geologists of the whole world.

The first part of Dr. Geikie's book deals with land-sculpture in general, and describes the working of Nature's sculpturing tools. It is possible that, here and in the corresponding portions of other geological works, sufficient stress is not laid on the paramount importance of frost among those denuding agents which are generally classed together as "sub-aërial." We might almost say that the results of its work exceed in importance those of all the other denuding forces put together. Such was the impression made upon me when it was once my lot to spend an autumn and winter at St. Bees. South of the bold scarp of St. Bees Head the coast is formed by a line of low cliffs of Boulder Clay, and on a strip of smooth sand at the foot of these it was my practice to take my daily "constitutional." The summer had been hot and dry, and the clay was abundantly cracked; the autumn was a time of incessant and often heavy rain. This almost continuous downpour produced but little destruction; streams of mud stained every here and there the clean sand, but the amount carried down was insignificant. Then came one night's frost, and the beach next day was a sight not easily forgotten. Huge masses of clay, some half as big as a small cottage, cumbered the shore all along; that single night's frost wrought more havoc than the deluge of rain which had been pouring down during the preceding three months almost without cessation.

Having cleared the ground by a preliminary exposition of the principles that are to be our guide, the author takes us away to the Highlands. He insists on the fact that there is nothing in Scotland that can be called a mountain chain in the scientific sense of the expression, and enforces, both by verbal description and apt pictorial illustration, the truth that, when from some commanding height we look over the wild tumbled sea of the Highland hills, it becomes forcibly borne in upon us that they nearly all rise to about the same height. The conclusions to be drawn are that the country was first of all worn down by denudation to an approximately uniform level, and that the valleys are merely ditches dug out by sub-aërial denuding agents across this old table-land. No visitor to the Highlands, who has on a clear day from some point of vantage looked around over the landscape

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that lies spread below him, can for a moment gainsay the fact, whatever may be his opinion as to the conclusions drawn from it: by nearly all geologists they are accepted as the only reasonable explanation. But we need not go to the Highlands to find instances of old table-lands, which have been trenched by sub-aërial denudation; and perhaps some examples on a smaller scale may be more easily appreciated by beginners. An admirable case is found in the south-west of England. Anyone who walks up from Bristol on to Clifton and Durdham Downs cannot fail to be struck by the remarkable evenness of their surface; after a long pull up a succession of steep inclines you find yourself all at once on a plateau as flat as an alluvial meadow. By dropping down into the gorge of the Avon, an equally good instance of a river-trench cut through the plateau is supplied, and at the same time proof is furnished that the present surface, so suggestive of level-bedded strata underneath, really cuts sheer across beds tilted at high angles, broken by faults, and bent into complicated folds. The flat top runs on along the line of limestone hills that connect Bristol with Clevedon; it is specially noticeable around Clevedon; and after we have crossed a broad depression occupied by softer Coal Measures and Secondary rocks, we find it reappearing in the flat-topped Mendips. Nor is it confined to the exposed portions of the limestone area. Where that rock is covered by Secondary strata, shafts sunk in making tunnels and other excavations show that the newer beds rest on an almost level surface of Palæozoic rocks. Over the whole country there can be traced, whether exposed or hidden, the clearest remnants of an old pre-Triassic table-land.

We also find in the Avon gorge that the limestone has undergone disturbances smaller in amount, but identical in kind, with the gigantic displacements of Sutherland and Ross-shire, of which a short account is given in the present volume, and which are most graphically depicted in a longitudinal section by Mr. Peach. Anyone who wishes to understand what "thrust-planes" are, will find here very good miniature examples. An announcement of the greatest interest is made by the author while touching on this part of his subject. He states that the general assemblage of the organisms in the Durness Limestone recalls none of the Lower Silurian formation of Wales, but rather some of the still older groups of the Lower Palæozoic series of Canada. This reminds us that Lapworth finds the best palæontological parallel to his Moffat series in North America. To speculate on the geographical distribution of animals at so distant a time is risky work, but we may be tempted to conjecture that one great life province included both Scotland and North America, while Wales and Central Europe formed parts of another. Maybe the buried Archæan ridge, the tops of which stick up through the Secondary rocks of the centre of England, formed a portion of the barrier between the two.

But to return to the book before us. Having made good his contention that there was a time when the whole of what is now the Highlands was a broad undulating table-land, and that all its manifold diversity of feature has been carved out by sub-aërial denudation, the author takes us to the hills, the valleys, and the lakes, and enforces his conclusion with a wealth of illustration and a series of word-pictures of the most vivid character, which can be appreciated only by a study of the work itself. The Southern Uplands he treats in a similar manner, and incidentally he puts in a strong plea for a district which possesses much beauty of an unobtrusive kind, but which is apt to be condemned as bare and monotonous.

The Midland Valley is next brought before our notice. How delightful is even a railway ride on a bright sunny day over this charming country! It is in the main a land of broad rolling hills and wide valleys, well wooded and well watered, pleasant to the eye from its brightness and its richness. But, if this were all, there would be, it must be confessed, somewhat of a sameness about it that might be accounted tiresome. But it is redeemed from any risk of monotony by numerous ranges or groups of hills, of moderate elevation, but high enough to tower well above the general level, of ruggeder and wilder forms than the flowing contours of the body of the country, and many of them peaky and mountainous in outline. These are formed of the products of the old volcanoes which were once sprinkled so thickly over the district: their rocks, being harder than the sedimentary beds among which they occur, have been able better to hold out against denudation and have therefore not been worn down to so low a level. A very similar little tract is found in West Shropshire, where the Wrekin, Caer Caradoc, the Cardington Hills, and some other hill-groups—none very high, but all mountains in miniature—introduce a delicious diversity in the rich pastoral country of the Severn valley.

So far we have looked at the book solely from a scientific point of view, and, if no more were said, a suspicion might arise in the minds of the readers of this notice that perhaps the work was a trifle dry. But a very slight acquaintance with the book itself will dispel any misgiving on this head. No one has done more than the author to elucidate the geology of Scotland, but he knows and loves his fatherland too well to look upon it merely as a field for geological research. Legend and history, old ballad and modern poetry, have all been pressed into his service, and he interweaves into his narrative allusion and quotation in a way that enlivens even the most technical parts of the volume. The chapter on "The Influence of the Physical Features of Scotland upon the People" shows well what a vast amount of human interest attaches even to so special a science as geology.

If the intending tourist in Scotland will before he starts read enough of this book to enable him to comprehend its general drift and line of argument, and if he will then take the book with him and study on the ground such of its illustrations and examples as lie on his road, he will ever after thank the author for having supplied him with a new pleasure. One great charm of travel in Scotland is that it is ever leading us through scenes rich in historic associations. The enjoyment derived from such a source may be vastly enhanced by the aid of this book; for he who has mastered its contents will feel an interest not in the events of the human epoch only, but will see in every peak, hill-side, valley, and lake that he passes the monuments of a history which carries him back through that long vista of the ages which geology has opened out to us.

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